

PHYSICS BASIS OF DISCREPANCIES BETWEEN MEASUREMENTS OF ELECTRON TEMPERATURE BY ECE AND THOMSON SCATTERING AND IMPACT ON THE TEMPERATURE DIAGNOSTICS FOR FUSION MACHINES

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Abstract

Discrepancies between the Electron Cyclotron Emission (ECE) and Thomson Scattering measurements of electron temperature were observed on JET, TFTR and more recently on FTU and JET in high performance , high electron temperature ($T_e > 7\text{KeV}$) plasmas in Deuterium-Tritium Campaigns. The physics basis of the differences of ECE and Thomson scattering measurements can be identified in the way the deviation of electron velocity distribution function(EVDF) from Maxwellian is affecting the spectrum of the detected radiation [1]. In this paper a short summary of the experimental results is presented on the ECE-Thomson discrepancy, leading to the need of building diagnostic systems measuring the electron velocity distribution function(EVDF). The Thomson Scattering system measures the spectrum of the scattered light which is proportional to the EVDF: so in principle improving the spectral resolution and the accuracy of the measurement could lead to the direct measurement of the EVDF. The achievement of these improvements has important technical implications on the input laser power and spectral analysis. The ECE spectrum measured can be compared with the black body radiation spectrum leading to the identification of the presence of a non-maxwellian part of the EVDF.

1. F P Orsitto et al , 30th IAEA Fusion Energy Conference (FEC) 2025 Chengdu, China, ‘ Physics basis of discrepancies between temperature measurements by ECE and Thomson Scattering in high performance plasmas on JET , EAST and DIII-D’, paper IAEA-CN-316-2673